Type 2 Diabetes Mellitus

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Diabetes mellitus is the most common chronic metabolic disease and a major source of morbidity and mortality. Type 2 diabetes mellitus (T2DM) is the most prevalent form accounting for around 90% of cases worldwide. Figures released by the International Diabetes Federation (IDF) in December 2021 show that more than half a billion adults globally are living with diabetes. This is a rise of 16% (74 million) since the previous IDF estimates in 2019. Worldwide, 537 million adults aged 20-79 years are living with diabetes, and 541 million adults have pre-diabetes, which places them at high risk of developing type 2 diabetes. The prevalence of diabetes worldwide is growing at an alarming rate, and is predicted to rise to 643 million by 2030, and 784 million by 2045. The diabetes epidemic is unfolding because of increasing obesity rates, sedentary lifestyles and an ageing population. [1]

There is no National Diabetes Registry in Ireland, therefore national estimates are not fully accurate. The figures below provided by Diabetes Ireland (January 2022), uses data modelled from the Scottish Diabetes Register. In Scotland, the prevalence of diabetes was 5.6% of the total census population in 2020. The table below outlines the total diabetes prevalence in Ireland at approximately 266,664. The prevalence of type 2 diabetes in Ireland is estimated at 234,398 (87.9% of the total diabetes population) and type 1 diabetes at 28,800 (10.8% of the total diabetes population), based on the Scottish prevalence. The true prevalence of type 2 diabetes in Ireland however, is likely to be higher, as hyperglycaemia develops gradually, and at the early stage many cases go undiagnosed.[1]

	Total *(census)* population	Total Diabetes Prevalence	Type 2 Diabetes Prevalence	Type 1 Diabetes Prevalence
Ireland *(estimate)*	4,761,865 *(CSO, 2016)*	266,664	234,398	28,800

Diabetes Ireland (2022). Diabetes Prevalence in Ireland. Diabetes Ireland. Available at: https://www.diabetes.ie/about-us/diabetes-in-ireland/

According to the 2015 Irish Longitudinal Study on Ageing (TILDA), 10% of adults aged 50 and over in Ireland have type 2 diabetes, rising to 16% in those aged 80 and over. The TILDA study revealed that 1:10 people with diabetes in this population are undiagnosed, and that a further 5.5% of the older population have pre-diabetes which puts them at an increased risk of developing Type 2 diabetes in the future.[2] The study also found that type 2 diabetes is more common in men (12%) than women (7%) and a self-reported history of hypertension, high cholesterol, being centrally obese and having low levels of physical activity also has strong correlation with both diabetes and pre-diabetes.[2]

The International Diabetes Federation Atlas 2021, ranked Ireland 7th in the world for diabetes related health expenditure per person. [3] The economic burden of diabetes on the Irish health care system is a major challenge for government and the HSE. National estimates comparing health-service use between people over 50 years of age with and without diabetes (2009-2011), show that diabetes was associated with an 87% increase in outpatient visits, a 52% increase in hospital admissions and a 33% increase in emergency department attendances.[1]

The CODEIRE study (2006) stated that costs associated with diabetes in Ireland consume between 4% and 6% of the annual healthcare expenditure. If the same percentage (4-6%) was to be applied to the Irish healthcare expenses in 2019, the costs associated with diabetes would have been as high as €1.2 billion to €1.4 billion, with approximately 50% of the costs associated with hospitalisations and treatment of complications. With the growing prevalence of diabetes in Ireland, comprehensive economic data is required to ensure that appropriate resources are allocated to the management of the disease. [4]

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Type 2 diabetes mellitus (T2DM) is an insulin-resistance condition with associated beta-cell dysfunction. It occurs when blood glucose levels are too high (hyperglycaemia) due to insufficient insulin production, or when the insulin that is produced by the pancreas is not working effectively. T2DM results from an interaction between genetic and environmental factors, and ranks high on the international health agenda as a global pandemic, and as a threat to human health and global economies.[5]

In T2DM, the response to insulin is diminished, and this is defined as insulin resistance. During this state, insulin is ineffective and is initially countered by an increase in insulin production to maintain glucose homeostasis. However, as the disease progresses, beta cells change and insulin secretion is unable to maintain glucose homeostasis, producing hyperglycaemia, resulting in T2DM.[6]

Type 2 diabetes mellitus is most commonly seen in people over the age of 40. However, it is also now increasingly seen in children, adolescents, and younger adults due to rising levels of obesity, physical inactivity, and energy-dense diets. [6] Most patients with T2DM are obese or have a higher body fat percentage, distributed predominantly in the abdominal region. This adipose tissue promotes insulin resistance through various inflammatory mechanisms, including increased FFA release and adipokine dysregulation. Lack of physical activity in people with hypertension or dyslipidaemia also increases the risk of developing T2DM.[6]

Chronic hyperglycaemia can cause damage to various organ systems, leading to the development of disabling and life-threatening health complications, most prominent of which are microvascular (retinopathy, nephropathy, and neuropathy) and macrovascular complications, leading to a 2 - 4-fold increased risk of cardiovascular diseases. [6]

Risk Factors

Obesity: Obesity and type 2 diabetes mellitus (T2DM) are closely linked and are increasing in prevalence worldwide. Both chronic conditions have multisystem impact and are associated with increased mortality and cardiovascular risk. The mechanisms linking obesity and T2DM are complex and still being understood. It is thought to involve a combination of adipose tissue release of excess circulating fatty acids, glycerol, hormones and pro-inflammatory cytokines, impairing cellular insulin signalling and increasing insulin resistance; and chronically raised lipid levels leading to impaired islet beta-cell function and lower levels of insulin production.[7]

Smoking, high alcohol consumption and reduced physical activity are factors that contribute to obesity and insulin resistance.

Age: Although T2DM can occur at any age, older age > 40 years is associated with the progressive reduction in glucose tolerance partly owing to the gradual decrease in responsiveness of beta-cells to carbohydrate.[7]

Genetics: Other risk factors include first-degree relatives of patients with diabetes, and women with gestational diabetes or polycystic ovary syndrome which increases the risk of impaired glucose regulation. The risk of first-degree relatives of patients with T2DM developing the condition is 40% compared with just 6% for the rest of the general population.[7]

Ethnicity: T2DM is two to four times more likely in people of south-Asian, Afro-Caribbean or black-African descent than people of white-European origin. Migration of various ethnic subgroups has led to a change in dietary habits, with a higher consumption of calories and fat than in their countries of origin; hence the prevalence of diabetes is often higher in immigrant communities than in their country of origin. [7]

Inflammation: Systemic inflammation also contributes to insulin resistance as an improvement in inflammatory markers, such as C-reactive protein and interleukin-6, are linked to an improvement in beta-cell function.[7]

Signs and Symptoms

Symptoms of T2DM originate from persistent hyperglycaemia and the impaired ability to use glucose as fuel, and include polyuria, nocturia, polydipsia, fatigue and weight loss. A person with diabetes may also experience other symptoms, such as blurred vision, reduced sensations or pain in the hands and feet, along with recurrent genitourinary infections.[7]

Owing to insulin deficiency and altered energy metabolism, diabetes increases the risk of developing hyperosmolar hyperglycaemic states and ketoacidosis, both of which are life-threatening emergencies that require prompt hospital treatment. Diabetic ketoacidosis is less common in people with T2DM, because most people are insulin resistant rather than insulin deficient. [7]

Criteria for testing for diabetes in asymptomatic adult individuals

Type 2 diabetes has a long pre-clinical phase and may be asymptomatic until well after long term microvascular and macrovascular complications have occurred. T2DM can be detected before the onset of symptoms and clinical signs by identifying people who are at risk and performing diagnostic testing. The onset of T2DM is subtle and early detection in general practice requires clinical suspicion combined with systematic and opportunistic findings. Early identification of patients and initiation of treatment can reduce the development of complications, and therefore testing for diabetes in asymptomatic patients with risk factors associated with the development of diabetes is recommended.[10]

Criteria for testing for Diabetes in asymptomatic adults Reference: ICGP (2016). A Practical Guide to Integrated Type 2 Diabetes Care. (Adapted from the ADA Clinical Practice Recommendations 2015 Diabetes Care) Source: National Clinical Programme- Diabetes Working Group
1. Testing for diabetes should be considered in all adults who are overweight (BMI ≥ 25kg/m^2) and who have one or more additional risk factors: • Physical inactivity • First-degree relative with diabetes • Are hypertensive (≥140/90mmHg) or on therapy for hypertension • Dyslipidaemia – HDL< 0.9 and/or triglycerides >2.82 • Have established arterial disease (IHD, CVA, PVD) • High-risk ethnicity (e.g. African, Asian, Hispanic etc.) • Members of the Travelling Community • Have delivered a baby weighing >4.1kgs or have a history of gestational diabetes mellitus (GDM) • On previous testing had Impaired Glucose Tolerance (IGT) or impaired Fasting Glucose (IFG) Have other clinical conditions associated with insulin resistance (e.g. polycystic ovary syndrome, acanthosis nigricans, long-term steroid use or severe obesity.
2. In the absence of the above additional risk factors, testing for diabetes should begin at age 45 years.
3. If the results are normal, testing should be repeated at least at 3 yearly intervals. Patients with IFG or IGT should be tested annually.

Diagnosis

A thorough medical history, physical examination and investigative tests are required to form a diagnosis for T2DM. The patient's history will include an assessment for risk factors such as a family history of diabetes, ethnicity, and increased age > 40 years old. The patient's vital signs and height, weight, and body mass index (BMI) should be recorded. The skin should be examined for wounds and signs of infection. Pulses should be palpated to examine for peripheral arterial disease, and microfilament testing to determine the presence of peripheral neuropathy. The eyes should be examined with an ophthalmoscope and assessed for retinopathy. A series of blood tests will be carried out including a fasting blood glucose.

Urinary glucose should not be used as a diagnostic test owing to its low sensitivity. Additional diagnostic tests are often required, such as 'GAD' autoantibody tests or C-peptide tests, to distinguish between T1DM and T2DM. Other types of DM must also be excluded, such as maturity-onset diabetes of the young, which is characterised by impaired insulin secretion with minimal or no defects in insulin action resulting from genetic defects in beta-cell function. [7]

The International Diabetes Federation and World Health Organisation criteria for T2DM [8, 9]

Presence of diabetes symptoms (e.g. frequent urination, thirst, unexplained weight loss) and one of the following abnormal test results:

- A fasting plasma glucose concentration of ≥7.0mmol/L;
- A random venous plasma glucose concentration of ≥11.1mmol/L;
- A plasma glucose concentration of ≥11.1mmol/L two hours after 75g anhydrous glucose in an oral glucose tolerance test;
- An HbA_{1c} level of ≥48mmol/mol (6.5%).

In the absence of diabetes symptoms, two abnormal test results are required for confirmation (preferably the same test).

Diagnosis can be made when fasting plasma glucose is ≥ 7.0mmol/L or random plasma glucose is ≥ 11.1mmol/L in the presence of symptoms such as frequent urination, thirst and unexplained weight loss. [7, 8]

The oral glucose tolerance test (OGTT) can also be used as a diagnostic tool, where a diagnosis is made if a plasma glucose level of ≥ 11.1mmol/L is measured two hours after the ingestion of a 75g glucose solution. The OGTT has largely been replaced by the HbA_{1c} test, and is now mainly used in the diagnosis of gestational diabetes. An HbA_{1c} result of 48mmol/mol (6.5%) is recommended as the threshold for diagnosing diabetes.[7, 8]

In an asymptomatic person, diagnosis should be confirmed with a repeat HbA_{1c} or plasma glucose test, preferably using the same test. However, if both HbA_{1c} or plasma glucose measurements are in diabetic range, a diagnosis can be made. If only one measurement is in range, a second abnormal result using the same test is required to confirm the diagnosis. [7, 8] There are patient groups in whom HbA_{1c} is inappropriate for diagnosis, including:

- Children
- Pregnant women
- People who are taking medicines such as steroids or antipsychotics that can cause an acute glucose
- People with acute pancreatic damage
- People with haematological conditions that may influence HbA_{1c} and its measurement example haemoglobinopathies, decreased erythropoiesis/administration of

erythropoietin, erythrocyte destruction, alcoholism, chronic kidney disease and chronic opioid use. [7]

Treatment and Management

Under the National Integrated Model of Care, patients with uncomplicated T2DM are seen 3 times a year in primary care in a structured fashion. Visits are every 4 months with an annual review. Patients who develop complications are referred from primary to secondary or tertiary care for an expert specialist opinion, and their care will become shared between primary and secondary or tertiary care. These patients will be seen at least once a year in secondary care for their annual review or more frequently according to the severity of the diabetes related complication and up to twice a year in primary care at 4-monthly intervals.[10]

The GP and the general practice nurse are primary care givers to patients and are key to the success of the delivery of integrated care. They make the diagnosis of diabetes, are the first health professionals the patient sees on receiving their diagnosis and are involved in the delivery of the diabetes and non-diabetes care over the life time of the patient.[10] The Clinical Nurse Specialist in Diabetes Integrated Care facilitates the successful integration of patient care between primary and secondary Care. They provide a primary care-based specialist diabetes nursing service to individual patients referred to them by general practitioners and general practise nurses. [10] A multidisciplinary team approach is required in diabetes care which includes doctors, nurses, endocrinologists, pharmacists, registered dieticians, and diabetes educators. Depending on which complications of diabetes are present, ophthalmologists, neurologists, cardiologists, pulmonologists, nephrologists, infectious disease specialists, and podiatrists also serve on the team. Physical therapists, occupational therapists, and speech therapists can assist when patients experience certain complications of diabetes such as cerebrovascular accident and foot amputation. Social workers and case managers can address psychosocial or financial issues along with needs for special equipment.[11]

Diabetes care should encompass patient education, dietary and lifestyle advice, management of cardiovascular risk, skin and foot care as well as detection and management of long-term complications. Patients with T2DM should be encouraged to eat high fibre, low glycaemic index sources of carbohydrates such as fruit, vegetables, wholegrains and pulses, as well as low fat dairy products and oily fish. They should be advised to maintain a healthy weight to maintain a BMI of between 20 and 25 kg/m2. [10, 11] Patients should be taught how to measure and understand their blood glucose levels. Quality control of the glucose monitor should be checked four times a year and monitors should be changed or upgraded every two years. Patients should be advised to record home glucose readings in their patient record book, and to bring the book to each of their diabetic reviews.[10]

NICE recommends that all patients with T2DM should be referred to a diabetes structured education programme at or around the time of diagnosis. Structured Diabetes Education is a group programme that provides patients with the knowledge, skill and ability to manage their diabetes. All patients with diabetes should receive the following checks at least once per year to reduce the risk of long-term complications: HbA_{1c} level; Blood pressure; Cholesterol; Retinal screening; Foot examination; Kidney function; Urinary albumin; Body mass index; Smoking status. Reducing glucose levels lowers the risk of all long-term complications of diabetes, while reducing cholesterol levels lowers the risk of heart attacks and strokes. [12]

First Patient Visit – Initial Assessment after Diagnosis includes the following elements[10]

Collect Demographic details	YES	NO
Patient name/ address/DOB/gender/ ethnicity		
Type of Diabetes – Uncomplicated Type 2 / Complicated Type 2/ Other		
Smoker		
Alcohol		

Diagnosis of Diabetes	YES	NO
• Date (year) of Diagnosis		
• Osmotic symptoms		
• Random plasma glucose		
• Fasting plasma glucose		
• 2hour OGTT		
• Fasting plasma glucose		
• HbA1c		
• Current medications & compliance history		
Family History of Diabetes		
Gestational Diabetes		
Past Medical History: • Coronary Artery Disease		
• MI		
• CVA		
• TIA		
• PAD		
• Erectile dysfunction		
• Thyroid disease		
• Other		
Examination		
Weight/Height – calculate BMI		
Blood Pressure		
Foot examination (as per National Model of Foot-Care) • Foot pulses • 10gm monofilament • Vibration sensation		
Waist circumference		
Investigation		
HbA1c		
Fasting Lipid Profile		
Full Blood Count		
Renal Function - Serum Creatinine, Urine Albumin Creatinine Ratio (ACR), eGFR		
Thyroid Function Tests		
Liver Function Tests		
Ferritin – serum iron/ transferrin saturation (if ferritin raised)		
12 lead ECG		
Referral		
Practice nurse education		
Structured education programme		
Exercise advice		
Dietitian*		
Podiatry		
Retinal screening		
Self Monitoring Blood glucose		
Clinical Nurse Specialist		
Add patient to practice register and give follow-up appointment		
Nominate Secondary Centre if appropriate		

***If not suitable for group structured education programme at time of diagnosis refer for individual session with dietitian**

Regular on-going review includes the following elements [10]

Regular review includes the following elements	Yes	No
Medications		
Hypoglycaemia/hyperglycemia		
Smoking Status		
Dietary Habits		
Physical activity		
Assess injection sites if on insulin		
Recent life-events / new symptoms		
Other medical conditions and therapy affecting diabetes, psychological, lifestyle and social aspects		
Examination		
Weight/Height – calculate BMI		
Blood pressure		
Foot examination as per National Model of Foot care • Foot pulse • 10gm monofilament • Vibration sensation		
Investigations		
HbA1c		
Recheck Lipids if raised at first or preceding review		
Urinalysis and ACR, calculate eGFR (if raised at first or preceding review)		
Blood pressure		
Referral follow-up		
Practice nurse education		
Structured education programme		
Retinal screening		
Podiatry		
Exercise advice		
Dietitian		
Podiatry		
Smoking Cessation		
Self management Blood Glucose Monitoring		
Pre-conceptual advice		

Annual Review [10]

Along with the areas monitored at the regular review, surveillance of the following should also be carried out annually:

Symptoms	ischaemic heart disease, peripheral vascular disease - neuropathy, erectile dysfunction. All patients with symptoms that might reflect vascular disease, particularly ischaemic heart disease, should be investigated.
Feet	footwear, deformity/joint rigidity, poor skin condition, ischaemia, ulceration, absent pulses, sensory impairment.
Eyes	visual acuity and retinal review by ophthalmologist/retinal screening programme.
Kidney	renal damage, albumin excretion, serum creatinine and calculate Egfr
Arterial risk	blood glucose, blood pressure, blood lipids, and smoking status, ECG
Attendances	podiatry / dietitian / other as indicated.

Structured education programme tailored to the patient's individual needs [10]

TOPICS TO BE COVERED WITH PATIENT	
• What is Diabetes	• Dietary Management
• Eye and Foot Care	• Behaviour modification
• Motivation Strategies	• Complications
• Aims of Diabetes Care	• Why self-monitoring may be needed
KEY SELF-CARE ISSUES TO BE COVERED WITH PATIENT	
• Medications: Uses and Side-Effects	• Self-Monitoring, if indicated
• Hypoglycaemia	• Allowances, Entitlements
• Hyperglycaemia	• Membership of Diabetes Ireland
• Sick-Days	
ADDITIONAL ISSUES AS APPROPRIATE FOR SPECIFIC PATIENT	
• Lifestyle: smoking, alcohol, exercise, weight control	• Employment, Insurance, Driving issues
• Cardiovascular Status: Hypertension, Hyperlipidaemia, Micro-albuminuria	• New Symptoms: Nocturia: frequency Dry mouth Chest pain: Sensation, Dyspepsia Visual disturbance Foot problems Impotence
• Managing Insulin	
• Travel Advice	
• Encouraging Self-care	
• Discussion with Carers	
• Family Planning or Pre-Conception Advice	

Medications

When lifestyle modification fails to achieve the targeted blood glucose levels, the first-line medication prescribed is metformin, both for those who are overweight (BMI >25.0kg/m2) and not overweight. Titration is from 500 to 2000 mg per day, administered with or after meals, and the use of extended-release (XR) preparations can maximise tolerance. Metformin dose should be reduced to 1000 mg per day when renal function is in stage 3A and contraindicated when renal function is in stage 3B or above. [8] Metformin is contraindicated in those with renal impairment and with end stage cardiac and hepatic failure. Metformin should be stopped in patients with eGFR <30 mls/min and at possibly higher values in patients prone to dehydration. [10]

Since 2015, NICE has been advocating a patient-centred approach to glycaemic control and provides best practice advice on setting glycaemic targets and selecting hypoglycaemic agents for treatment intensification after metformin first-line treatment for T2DM, in those with inadequate diabetes control. [12]

One of the main recommendations in the NICE guideline is the broadening of the choices of second-line hypoglycaemic agents, either as an adjunct to metformin or as first-line therapy if metformin is not tolerated or is contraindicated. These agents are a dipeptidyl peptidase-4 (DPP-4) inhibitor, sulfonylurea, pioglitazone and a sodium–glucose cotransporter 2 (SGLT-2) inhibitor. GLP-1 receptor agonists and insulin therapy except for insulin being used as rescue

therapy in those with symptomatic hyperglycaemia, are generally recommended as 3rd-line agents. [12]

The second recommendation from NICE describes setting an individualised HbA_{1c} target, which aims to intensify treatment when HbA_{1c} rises to ≥ 58mmol/mol (7.5%). Advice on diet, lifestyle and medicines adherence should be reinforced to support the patient to aim for an HbA_{1c} target of 53mmol/mol (7.0%). Patients who are taking a single drug that is not associated with hypoglycaemia, for example metformin or a DPP-4 inhibitor, should aim for a tighter HbA_{1c} target of 48mmol/mol (6.5%). Patients who are taking a single drug that is associated with hypoglycaemia, for example a sulfonylurea, an HbA_{1c} target of 53mmol/mol (7.0%) should be set. A higher HbA_{1c} target should be set for those in whom a target of 53mmol/mol would impair their quality of life, for example, if it causes hypoglycaemic episodes. In the presence of frailty or for those with a limited life expectancy, a relaxed glycaemic target should be considered based on the level of frailty, where an HbA_{1c} of up to 70mmol/mol (8.5%) may be considered appropriate. [12]

Most guidelines recommend the use of insulin alone or in combination with other GLDs when persons with T2DM are unstable, with sign and symptoms of acute decompensation including dehydration, acute weight loss, acute illness, very high glucose levels and presence of ketones. Basal insulin should be preferred and it can be temporary. Most insulin algorithms start with 10 unit or 0.2 units/kg and titrate once or twice weekly at 1 to 2 units each time to achieve a target fasting blood glucose between 3.9 and 7.2 mmol/L (70 and 130 mg/dL). [8]

Diabetic Foot Model of Care 2021: T2DM [13]

The aim of diabetic foot screening and risk classification is to establish the person's risk of diabetic foot ulceration. All persons with diabetes are assigned a risk category and where appropriate referred for ongoing foot screening, a foot assessment and a clinical care plan. The care plan ensures that all people with diabetes receive annual or more frequent foot screening, foot care education and review according to their clinical needs and in the most appropriate setting.[13]

CATEGORY	WHO IS RESPONSIBLE FOR DIABETIC FOOT SCREENING?
People who have newly diagnosed type 2 diabetes	General Practitioner or Practice Nurse
People who have type 2 diabetes and are at low risk of diabetic foot disease [7]	General Practitioner or Practice Nurse
People who have newly diagnosed type 1 diabetes	Secondary Care Endocrinology Team
People who have type 1 diabetes at low risk of diabetic foot disease	Secondary Care Endocrinology Team
All people with diabetes who are at moderate or high risk of diabetic foot disease	Foot Protection Team Podiatrists
All people with diabetes who are in remission from diabetic foot disease	Foot Protection Team Podiatrists
All people with diabetes who have active foot disease	Multidisciplinary Foot Team Podiatrists

- Diabetic foot screening and management will primarily be provided by:
  - General Practitioners (GP) and Practice Nurses
  - Foot Protection Teams (FPT)
  - Multidisciplinary Foot Care Teams (MDFT)
- At diagnosis of type 2 diabetes (T2DM), a person should have initial foot screening and risk classification within General Practice.
- A person with T2DM, who is deemed at low risk of diabetic foot ulcer (DFU), should have annual foot screening and care provided within General Practice as part of their annual diabetes review .
- A person with T2DM who is deemed at moderate risk of DFU should have annual foot screening and review by the Foot Protection Team.
- A person with T2DM who is deemed at high risk of DFU should have 6–monthly foot screening and review by the Foot Protection Team.
- A person with T2DM who is in remission from DFU should have 3–6 monthly foot screening and review by the Foot Protection Team.
- A person with T2DM who has active foot disease must be referred, treated and managed by the MDFT. Clear and explicit referral pathways to the MDFT should exist to ensure access to this team in a timely manner. The MDFT should aim to review those with active foot disease within 24 hours of referral (or next working day). Where there are signs of sepsis the person should be referred immediately to the Emergency Department and the MDFT should be notified as a matter of urgency.

Exception: Those with very complicated T2DM, should have annual foot screening and care provided by the Endocrinologist and their team.

Diabetic foot screening process: screening includes: [13]

- **MEDICAL HISTORY**
  HISTORY OF CHARCOT FOOT
  HISTORY OF FOOT SURGERY
  HISTORY OF PREVIOUS FOOT ULCER OR AMPUTATION (ON EITHER FOOT)
  PRESENCE OR ABSENCE OF INTERMITTENT CLAUDICATION OR REST PAIN
  KIDNEY FUNCTION
- **FOOT INSPECTION**
  INSPECTION OF SKIN AND NAILS
  INSPECTION FOR STRUCTURAL FOOT DEFORMITY
  INSPECTION OF ANY EXISTING FOOT WOUNDS
  EXAMINATION OF FOOTWEAR
  REVIEW OF ORTHOTIC DEVICES AND AIDS AND APPLIANCES.
- **PERIPHERAL SENSORY ASSESSMENT**
  VIBRATION PERCEPTION TESTING (128 HZ TUNING FORK)
  CUTANEOUS PRESSURE PERCEPTION TESTING (SEMMES WEINSTEIN TEST: 10G MONOFILAMENT)
- **PERIPHERAL VASCULAR ASSESSMENT:**
  PALPATION OF FOOT PULSES

Based on the findings of this screening the person is categorised as being low, moderate or high risk of future diabetic foot ulceration, or if known to have prior foot ulceration will be categorised as being in remission or categorised as active foot disease, if foot ulceration is present or active Charcot is suspected.[13]

Complications of T2DM

Long-term complications of T2DM include diabetic retinopathy, diabetic nephropathy, diabetic neuropathy and macrovascular problems.

Diabetic retinopathy is one of the most common causes of blindness in the working age population in Ireland. Up to 10 per cent of people with diabetes are at risk of sight threatening retinopathy. Diabetic retinopathy may have no obvious symptoms in its early stages but when caught early, treatment is effective at reducing or preventing damage to sight. [10]

Diabetic nephropathy is a significant cause of chronic kidney disease and end-stage renal failure globally. If untreated, diabetic nephropathy can lead to impaired kidney function, dialysis and/or kidney transplant. Diabetic nephropathy is identified when eGFR is <60 mL/min/1.73 m^2 and albuminuria >30 mg/g creatinine.[8, 14]

Diabetic neuropathy is the most common complication associated with diabetes mellitus. Diabetes causes a broad spectrum of neuropathic complications, including peripheral, autonomic, proximal, and focal. Diabetic peripheral neuropathy is the most common form of nerve damage, and it most often affects the nerves to the hands and feet. Diabetic peripheral neuropathy (DPN) leads to distressing and expensive clinical sequelae such as foot ulceration, leg amputation, and neuropathic pain. DPN is often diagnosed late when irreversible nerve injury has occurred, and its first presentation may be with a diabetic foot ulcer.[1]

Type 2 diabetes can also affect the large blood vessels, causing plaque to build up, leading to a heart attack, stroke and peripheral vascular disease. Cardiovascular disease (CVD) is the leading cause (∼70%) of death in people with type 2 diabetes. People with diabetes have a 4-fold-greater risk for having a CVD event than people without diabetes after controlling for traditional risk factors for CVD, such as age, obesity, tobacco use, dyslipidaemia, and hypertension.[16]

Prevention and Patient Education

Patient education and effective lifestyle modifications including weight loss, and adoption of a healthy diet together with increased physical activity are the cornerstones for the prevention of type 2 diabetes mellitus. Emphasis must be placed on promoting a healthier lifestyle, and finding solutions for increased adherence and compliance, especially for high risk individuals.

Diabetes SMART is a new free interactive online education course developed by Diabetes Ireland, for people diagnosed with Type 2 diabetes. The Diabetes SMART programme contains six interactive modules, covering topics that explain what diabetes is, understanding the key medical information such as blood glucose levels, managing illness, and providing tips on healthy eating and getting active. The programme was developed by diabetes healthcare

professionals, and the resource will give people with Type 2 diabetes the knowledge and accessible tools to learn how to manage their condition and protect their future health.[1]

Outlook

While there is still no cure for T2DM, several drugs are in their developmental stages. Perhaps, the most anticipated is the glucagon-like peptide-1 (GLP-1) receptor agonists, which induce insulin production while also suppressing the secretion of glucagon.[7]

Imeglimin, a drug being developed by the French company Poxel, has shown great promise in a phase III clinical trial in Japan. Damage to the mitochondria, the structures that generate energy within cells, plays a key role in the progression of metabolic diseases, and Imeglimin protects mitochondria from damage. With this unique method of action, imeglimin has the potential to treat type 2 diabetes by acting in three organs at once: the pancreas, the liver and the muscles to reduce blood glucose levels. [16]

Adjustments to dietary nutrient composition, insulin-secreting cell implants, bariatric surgery and agents primarily designed to suppress appetite and reduce adiposity will also greatly contribute to the future management of type 2 diabetes mellitus.

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